PATENT ABSTRACTS OF JAPAN

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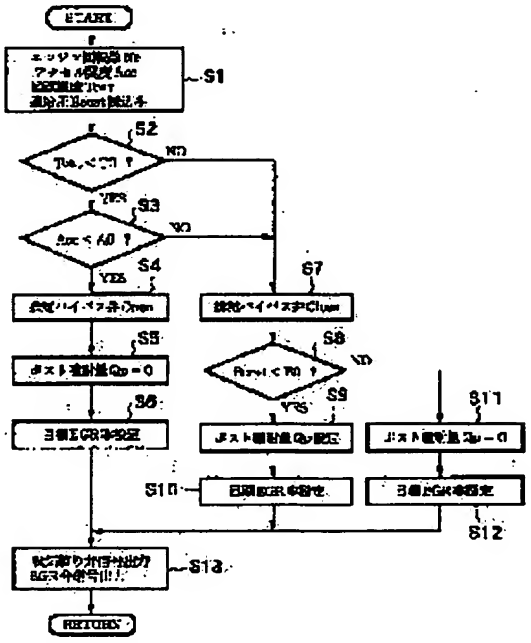
(54) SUPERCHARGING PRESSURE CONTROL DEVICE FOR INTERNAL COMBUSTION ENGINE

(57)Abstract:

PROBLEM TO BE SOLVED: To improve the responsiveness of a supercharging pressure rise.

SOLUTION: If the temperature of an exhaust purifying catalyst is low and there is no acceleration request, exhaust bypassing a turbine of a turbosupercharger and maintaining high temperature is led to the catalyst to promote temperature raising activation (Step 1 to 4). In the process, if the catalyst is active or an acceleration request occurs, the exhaust bypassing of the turbine is prohibited, and if supercharging pressure is not higher than a given level, a postinjection is executed to elevate exhaust temperature and promote rises in turbine rotation and interlocked compressor rotation, which in turn suppresses lag in supercharging pressure rise. An excess air ratio corresponding to the postinjection quantity is controlled to suppress degradation in HC, CO and the like (Step 7 to 12).



LEGAL STATUS

[Date of request for examination]

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CLAIMS

[Claim(s)]
[Claim 1] The charge pressure control device of the internal combustion engine which is the charge pressure control device of the internal combustion engine which carried the turbosupercharger which performs inhalation-of-air supercharge by the compressor which rotates with the turbine driven by the exhaust stream, and is characterized by performing postinjection after the Maine injection of a fuel when raising the charge pressure of said turbosupercharger.
[Claim 2] The charge pressure control unit of the internal combustion engine characterized by performing said Maine injection and postinjection with the injector [ON-OFF / with a solenoid valve / injector / injection of a fuel].
[Claim 3] The active state of an exhaust air purification means to purify the exhaust air component which is arranged in the flueway of the turbine lower stream of a river of said turbosupercharger, and flows is judged. The bypass flow rate of the exhaust air which bypasses said turbine and is led to said exhaust air purification means when this exhaust air purification means has not carried out activity is enlarged. It is the charge pressure control unit of the internal combustion engine according to claim 1 or 2 characterized by performing said postinjection when switching said bypass flow rate to smallness from size while performing bypass control of flow which makes said bypass flow rate small, when said exhaust air purification means carries out activity.
[Claim 4] The charge pressure control unit of the internal combustion engine according to claim 3 characterized by controlling the opening of the exhaust air bypass valve infixed in the bypass path which bypasses said turbine, and controlling said bypass flow rate.
[Claim 5] The charge pressure control unit of the internal combustion engine of any one publication of claim 1 characterized by performing said postinjection when said charge pressure or an inhalation air content is detected and this detection value is less than a predetermined value - claim 4.
[Claim 6] The charge pressure control unit of the internal combustion engine according to claim 5 characterized by setting up many postinjection quantity, so that said charge pressure or an inhalation air content is low to desired value.
[Claim 7] When an excess air factor is controlled at least using one side of the EGR control which makes a part of exhaust air flow back to inhalation of air, and the throttling control of an inhalation-of-air path and said exhaust air purification means has not carried out activity It is the charge pressure control unit of the internal combustion engine of any one publication of claim 3 characterized by controlling an excess air factor highly, so that there is much postinjection quantity while an excess air factor is controlled low and the exhaust air purification means is carrying out said postinjection after activity - claim 6.
[Claim 8] It is the charge pressure control unit of the internal combustion engine of any one publication of claim 3 characterized by carrying out postinjection while making small the bypass flow rate of said exhaust air even if it is the case where said exhaust air purification means has not carried out activity when there is an acceleration demand based on accelerator actuation of an operator and said charge pressure or an inhalation air content is less than a predetermined value - claim 7.
[Claim 9] The charge pressure control unit of the internal combustion engine according to claim 8 characterized by the time when an acceleration demand is larger making small the bypass flow rate of said exhaust air.
[Claim 10] The charge pressure control unit of the internal combustion engine according to claim 8 or 9 with which the time when an acceleration demand is larger is characterized by setting up said predetermined value greatly.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to charge pressure control of the internal combustion engine which carried the turbosupercharger.
[0002]
[Description of the Prior Art] By the diesel power plant for cars, wearing of exhaust air purification means, such as trap equipment which carries out uptake of the catalyst which is generally equipped with the supercharger for the improvement in an output, and purifies HC, CO, and NOx, or the PM (exhaust air particle), is beginning to be realized. When the exhaust air purification catalyst with which the turbine lower stream of a river of a turbosupercharger was equipped has not carried out activity to JP,5-44448,A, the exhaust air which bypassed the turbine and controlled cooling in a turbine is led to a catalyst, and the technique which was made to supercharge by stopping the bypass of said exhaust air is indicated after catalytic activity.
[0003]
[Problem(s) to be Solved by the Invention] However, among an exhaust air bypass, when an acceleration demand is immediately after a catalyst carries out activity and stops an exhaust air bypass since the rotational speed of a supercharger is low (i.e., when the demand injection quantity increases), the response delay (rise delay of charge pressure) of a supercharger is large, and the increment in an inhalation air content does not catch up to the increment in fuel oil consumption, but an air-fuel ratio falls, and a possibility of inviting the increment in a smoke and aggravation of operability is.
[0004] This invention was made paying attention to such a conventional technical problem, controls the rise delay of charge pressure, and aims at enabling it to also maintain the exhaust air purification engine performance good.
[0005]
[Means for Solving the Problem] For this reason, invention concerning claim 1 is the charge pressure control device of the internal combustion engine which carried the turbosupercharger which performs inhalation-of-air supercharge by the compressor which rotates with the turbine driven by the exhaust stream, and when raising the charge pressure of said turbosupercharger, it is characterized by performing postinjection after the Maine injection of a fuel.
[0006] Since according to invention concerning claim 1 an exhaust-gas temperature can be raised enough [often / a response / and] to an elevated temperature and the enthalpy of exhaust air of a turbine inlet port can be promptly increased by postinjection, turbine rotation can go up quickly and can raise charge pressure promptly by the compressor which this turbine and really rotates.
[0007] Since the quantity of an inhalation air content is increased with a sufficient response when the time of the acceleration which increases a fuel, and charge pressure fall to below predetermined by this, the increment in a smoke can be prevented and good operability can be obtained. Moreover, invention concerning claim 2 is characterized by performing said Maine injection and postinjection with the injector [ON-OFF / with a solenoid valve / injector / injection of a fuel].
[0008] According to invention concerning claim 2, the Maine injection and postinjection are controllable by ON-OFF of the fuel injection by the solenoid valve with high precision. Moreover, invention concerning claim 3 judges the active state of an exhaust air purification means to purify the exhaust air component which is arranged in the flueway of the turbine lower stream of a river of said turbosupercharger, and flows. The bypass flow rate of the exhaust air which bypasses said turbine and is led to said exhaust air purification means when this exhaust air purification means has not carried out activity is enlarged. When said exhaust air purification means carries out activity, while performing bypass control of flow which makes said bypass flow rate small, when switching said bypass flow rate to smallness from size, it is characterized by performing said postinjection.
[0009] According to invention concerning claim 3, when the exhaust air purification means [an NOx trap catalyst, an oxidation catalyst, DPF (diesel particulate filter), etc.] has not carried out activity at low temperature, the activity of an exhaust air purification means is promoted by enlarging an exhaust air bypass flow rate by controlling cooling of exhaust air by the heat dissipation to a turbine, and raising an exhaust-gas temperature.
[0010] And if an exhaust air purification means carries out activity, said bypass flow rate will be switched to smallness (0 is included) from size, and the charge pressure of said turbosupercharger will be raised. At this time, charge pressure can be promptly raised by performing said postinjection, preventing the increment in a smoke. Moreover, invention concerning claim 4 is characterized by controlling the opening of the exhaust air bypass valve infixed in the bypass path which bypasses said turbine, and controlling said bypass flow rate.
[0011] According to invention concerning claim 4, said bypass flow rate can be enlarged by making said bypass flow rate small by making opening of an exhaust air bypass valve into smallness, and making opening of an exhaust air bypass valve into size. In addition, when switching the opening of an exhaust air bypass valve to smallness from size and increasing a bypass flow rate, it carries out, but postinjection is continuously performed, also when the charge pressure immediately after making opening of an exhaust air bypass valve into smallness is in a still low condition. Or opening of an exhaust air bypass valve is performed for postinjection, before the switch to smallness from size, and charge pressure can already be raised at the time of switch termination.
[0012] Moreover, invention concerning claim 5 is characterized by performing said postinjection, when said charge pressure or an inhalation air content is detected and this detection value is less than a predetermined value. According to invention concerning claim 5, since only between until charge pressure or an inhalation air content reaches a predetermined value carries out postinjection, it can minimize the period which carries out postinjection to which fuel consumption gets worse, and can be compatible in the fuel consumption engine performance a smoked reduction and operation disposition top.
[0013] Moreover, invention concerning claim 6 is characterized by said charge pressure or an inhalation air content setting up many postinjection quantity, so that it is low to desired value. Improvement in smoked reduction and operability is attained controlling the

fuel consumption aggravation by postinjection to the minimum, since the quantity of the postinjection quantity can be gradually decreased if many postinjection quantity is set up in early stages of acceleration when the delay of charge pressure is big since according to invention concerning claim 6 many postinjection quantity is set up so that charge pressure or an inhalation air content is low to desired value, and charge pressure goes up.
[0014] Moreover, invention concerning claim 7 is characterized by to control an excess air factor low, when an excess air factor is controlled at least using one side of the EGR control which makes a part of exhaust air flow back to inhalation of air, and the throttling control of an inhalation-of-air path and said exhaust-air purification means has not carried out activity, and to control an excess air factor highly, so that there is much postinjection quantity while the exhaust-air purification means is carrying out said postinjection after activity.
[0015] According to invention concerning claim 7, when the exhaust air purification means has not carried out activity at low temperature, an exhaust-gas temperature is raised by not performing postinjection but controlling an excess air factor low, it combines with the temperature up effectiveness by the bypass of exhaust air, and the temperature up of the exhaust air purification means can be carried out promptly, and it can carry out activity. Moreover, when postinjection is under operation, HC at the time of postinjection and aggravation of CO can be controlled by controlling an excess air factor highly.
[0016] Moreover, invention concerning claim 8 is characterized by carrying out postinjection, while making small the bypass flow rate of said exhaust air even if it is the case where said exhaust air purification means has not carried out activity when there is an acceleration demand based on accelerator actuation of an operator and said charge pressure or an inhalation air content is less than a predetermined value.
[0017] when there is an acceleration demand based on accelerator actuation of an operator according to invention concerning claim 8, even if it is the case where the exhaust air purification means has not carried out activity -- an exhaust air bypass flow rate -- small -- carrying out (0 being contained) -- since postinjection is carried out until charge pressure or an inhalation air content reaches a predetermined value, priority can be given to an acceleration demand and it can fill.
[0018] Moreover, invention concerning claim 9 is characterized by the time when an acceleration demand is larger making small the bypass flow rate of said exhaust air. According to invention concerning claim 9, the acceleration nature which brought the rise of charge pressure forward because the time when an acceleration demand is larger makes small the bypass flow rate of said exhaust air, and balanced the demand can be obtained.
[0019] Moreover, as for invention concerning claim 10, the time when an acceleration demand is larger is characterized by setting up said predetermined value greatly. According to invention concerning claim 10, by prolonging the period which carries out postinjection, the rise of charge pressure can be maintained and the acceleration nature corresponding to a demand can be obtained because the time when an acceleration demand is larger sets up said predetermined value greatly.
[0020]
[Embodiment of the Invention] Below, the operation gestalt of this invention is explained based on drawing. In drawing 1 , the common rail type fuel-injection system which consists of a common rail 2, an injector [ON-OFF / with a solenoid valve / injector / injection of a fuel] 3, and a supply pump which is not illustrated is used for the fuel-injection system of an engine (internal combustion engines, such as a diesel power plant) 1.
[0021] turbine 5T of a turbosupercharger 5 prepare in the lower stream of a river of an exhaust manifold 4 -- having -- this -- it is equipped with compressor 5C on turbine 5T and the same axle. After compression pressurization is carried out by compressor 5C, inhalation of air passes along the inhalation-of-air path 6, and is inhaled in the cylinder of an engine 1 through a collector 7. In order to extract inspired air volume in the middle of the inhalation-of-air path 6, the inhalation-of-air throttle valve 8 is attached. Moreover, the charge pressure sensor 9 which detects charge pressure (intake pressure) is attached in the collector 7.
[0022] Said exhaust manifold 4 and inhalation-of-air path 6 are opened for free passage by the EGR path 10, and the amount of EGR gas is controlled by opening of the EGR valve 11 infixed in said EGR path 10. The flueway 12 of turbine 5T lower stream of a river is equipped with the sensor 14 whenever [catalyst temperature], in order to be equipped with a catalyst (exhaust air purification means) 13 and to detect the temperature of this catalyst 13. The exhaust manifold 4 of ******** and the flueway 12 of the downstream are opened for free passage by the bypass path 15, and the opening area of the bypass path 15 is controlled by the exhaust air bypass valve 16.
[0023] Whenever [catalyst temperature / which was detected by the sensor 14 whenever / engine rotation speed signal / which was detected by the rotational-speed sensor 31 /, accelerator opening signal / which was detected by the accelerator opening sensor 32 /, and catalyst temperature], a signal and the charge pressure signal detected by the charge pressure sensor 9 are inputted into the engine control unit 17, and the actuation command signal to an injector 3, the inhalation-of-air throttle valve 8, the EGR valve 11, and the exhaust air bypass valve 16 is outputted to it based on each signal.
[0024] Next, control of this operation gestalt is explained according to the flow chart of drawing 2 . At step 1, Tcat and charge pressure Boost are read from each above-mentioned sensor whenever [engine-speed Ne, accelerator opening Acc, and catalyst temperature]. At step 2, it judges whether Tcat is less than [predetermined value T0] whenever [catalyst temperature]. Let the predetermined value T0 be a value (for example, 200-degreeC) equivalent to the activation temperature (temperature from which the effectiveness which purifies an exhaust air component generally becomes 50%) of a catalyst here.
[0025] When Tcat is less than [predetermined value T0] whenever [catalyst temperature], it progresses to step 3 and judges whether the accelerator opening Acc is less than [predetermined value A0]. That is, the existence of an acceleration demand of an operator is judged. Here, rate-of-change deltaAcc of accelerator opening may judge by whether it is less than deltaA0 predetermined value. When the accelerator opening Acc is less than [predetermined value A0] (i.e., when it is judged that there is no acceleration demand), control which progresses to henceforth [step 4] and promotes warming up of a catalyst 13 is performed.
[0026] Opening of the exhaust air bypass valve 16 is considered as full open, and the by-pass rate of turbine 5T is made to increase at step 4. Thereby, the temperature fall of the exhaust air which can control heat dissipation of exhaust air and is led to a catalyst to turbine 5T is controlled. It is referred to as postinjection-quantity Qp=0 at step 5. Postinjection of long duration is forbidden at the time of catalyst warming up, and fuel consumption aggravation and exhaust air performance degradation are controlled.
[0027] In step 6, a target EGR rate is set up in the following procedures. First, based on an engine speed Ne and the accelerator opening Acc, radical Motome label EGR rate MEGR0 is set up from the table of drawing 4 . Next, based on Tcat, it asks for the 1st correction factor alpha of an EGR rate whenever [catalyst temperature] from the table of drawing 4 . The 1st correction factor alpha of an EGR rate is set as such a large value that Tcat is [whenever / catalyst temperature] low like illustration. The product of radical Motome label EGR rate MEGR0 and the 1st correction factor alpha of an EGR rate is set to target EGR rate MEGR at the last.
[0028] If an EGR rate is made to increase on condition that the same charge pressure, the air content inhaled to a cylinder will decrease and a rate with fuel oil consumption, i.e., an excess air factor, will fall. Since according to the above-mentioned actuation a target EGR rate is highly amended so that Tcat is [whenever / catalyst temperature] low, an excess air factor falls. Thus, by reducing

an excess air factor, the amount of air [low temperature / under inhalation of air] (new mind) decreases, and the inhalation-of-air temperature rise by increase in quantity of elevated temperature EGR gas can raise an exhaust-gas temperature conjointly, and can heighten the temperature up effectiveness of a catalyst.
[0029] When it is judged that Tcat carries out at step 2 and the catalyst is carrying out activity more than by predetermined value T0 whenever [catalyst temperature], or when the accelerator opening Acc is judged that there is an acceleration demand beyond predetermined value A0 at step 3, it progresses to step 7 so that priority may be given to supercharge and the acceleration engine performance may be secured, and opening of the exhaust air bypass valve 16 is made into a close by-pass bulb completely, and the bypass of turbine 5T is forbidden. In addition, when it progresses to step 7 from step 3, you may make it set up the opening of the exhaust air bypass valve 16 according to an acceleration demand. That is, it does not consider as a close by-pass bulb completely, but as the time when Acc-A0 (or delta Acc-delta A0) is larger is brought close to a close by-pass bulb completely, you may make it decrease the rate to bypass.
[0030] At step 8, it judges whether the detected charge pressure Boost is less than [predetermined value B0], and in the case of below predetermined value B0, it is step 9, and it sets up the postinjection quantity Qp based on the map of drawing 5 . Here, the postinjection quantity Qp is set as such a large value that charge pressure Boost is low. That is, by making [many] the postinjection quantity Qp and fully raising an exhaust-gas temperature, the enthalpy of a turbine inlet port can be enlarged, the exhaust air energy-recovery effectiveness in a turbine can be raised, the inhalation-of-air work of compression by the compressor can be made to be able to increase, and charge pressure can be promptly raised, so that charge pressure Boost is low. Here, when it has progressed from step 3, the predetermined value B0 may be set up according to a service condition (acceleration demand). That is, when Acc-A0 (or delta Acc-delta A0) is large, you may make it set up the predetermined value B0 greatly. Moreover, based on an inhalation air content, you may judge instead of charge pressure. Namely, it progresses to step 9 at the time of the inhalation air content Qac< desired value Qac0.

[0031] At the following step 10, a target EGR rate is set up with the following procedures. First, based on an engine speed Ne and the accelerator opening Acc, radical Motome label EGR rate MEGR0 is set up from the map of drawing 3 like step 6. Next, based on the postinjection quantity Qp, it asks for the 2nd correction factor beta of an EGR rate from the table of drawing 6 . The 2nd correction factor beta of an EGR rate is set as such a small value that there is much postinjection quantity Qp like illustration. The product of radical Motome label EGR rate MEGR0 and the 2nd correction factor beta of an EGR rate is set to target EGR rate MEGR at the last. In order to make target EGR rate MEGR low by this so that there is much postinjection quantity Qp, an excess air factor will be set up highly. That is, the fuel postinjection was carried out [the fuel] by Excess EGR preventing carrying out a flame failure, a target EGR rate is set up so that the temperature up effectiveness by EGR can be acquired.
[0032] When charge pressure Boost is judged more than as predetermined value B0 at step 8, it progresses to step 11 and is referred to as postinjection-quantity Qp=0. Moreover, at the following step 12, based on an engine speed Ne and the accelerator opening Acc, radical Motome label EGR rate MEGR0 is read in the map of drawing 3 , and this is set to target EGR rate MEGR. That is, reduction amendment of the target EGR rate by the postinjection quantity Qp is not performed. That is, postinjection enables it to maintain the sufficiently high temperature up effectiveness so that an exhaust-gas temperature may be made to shift to the temperature up by EGR, after going up to some extent, a short-time deed and only when charge pressure is small since it leads to aggravation of fuel consumption, HC, and CO, although often [a response] and fully raised, and charge pressure may reach promptly to desired value.
[0033] Finally, based on the target EGR rate set up at the above-mentioned steps 6, 10, and 12, the opening signal of the inhalation-of-air throttle valve 10 and the EGR valve 14 is calculated and outputted at step 13. In addition, although the case where only EGR control was performed was explained when controlling an excess air factor, the inhalation-of-air throttle valve 10 may be used together and controlled by the above-mentioned operation gestalt. That is, by carrying out throttling control of the inhalation-of-air throttle valve 10, and decreasing a direct air content, a response is good and an excess air factor can fully be made smaller than an EGR control independent case.
[0034] Moreover, although postinjection is performed with this operation gestalt after closing the exhaust air bypass valve 16, the initiation stage of postinjection may be set as a front [stage / of the exhaust air bypass valve 16 / clausilium], or coincidence.

[Translation done.]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] Drawing showing the system configuration of the operation gestalt of this invention.
[Drawing 2] The flow chart which shows the control routine of the above-mentioned operation gestalt.
[Drawing 3] The map which searches for the radical Motome label EGR rate used with the above-mentioned operation gestalt.
[Drawing 4] The map which similarly sets up the 1st correction factor alpha of an EGR rate.
[Drawing 5] The table which similarly sets up the postinjection quantity Qp.
[Drawing 6] The map which similarly sets up the 2nd correction factor beta of an EGR rate.
[Description of Notations]
1 Engine
3 Injector
5 Turbosupercharger
5T Turbine
5C Compressor
8 Inhalation-of-Air Throttle Valve
9 Charge Pressure Sensor
10 EGR Path
11 EGR Valve
13 Catalyst
14 It is Sensor whenever [Catalyst Temperature].
15 Bypass Path
16 Exhaust Air Bypass Valve

[Translation done.]

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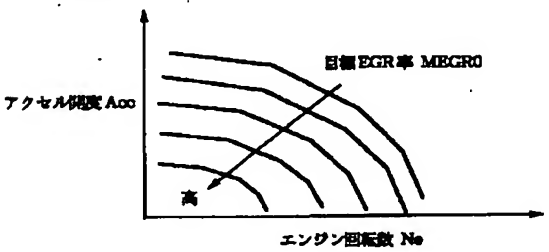
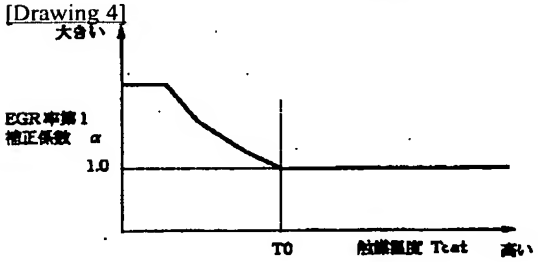
DRAWINGS

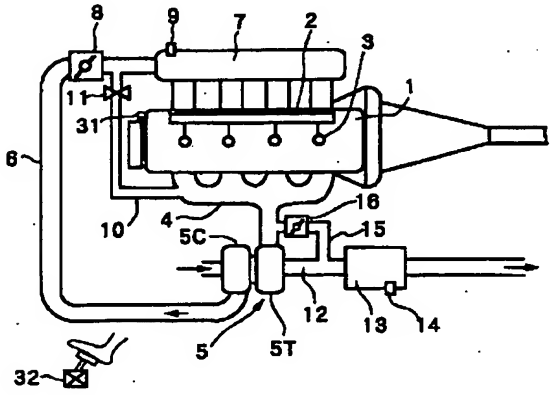
[Drawing 3]

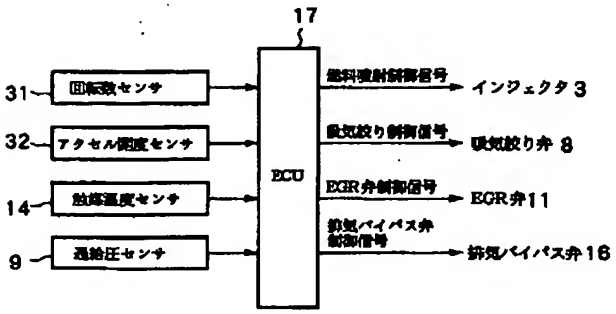


[Drawing 4]

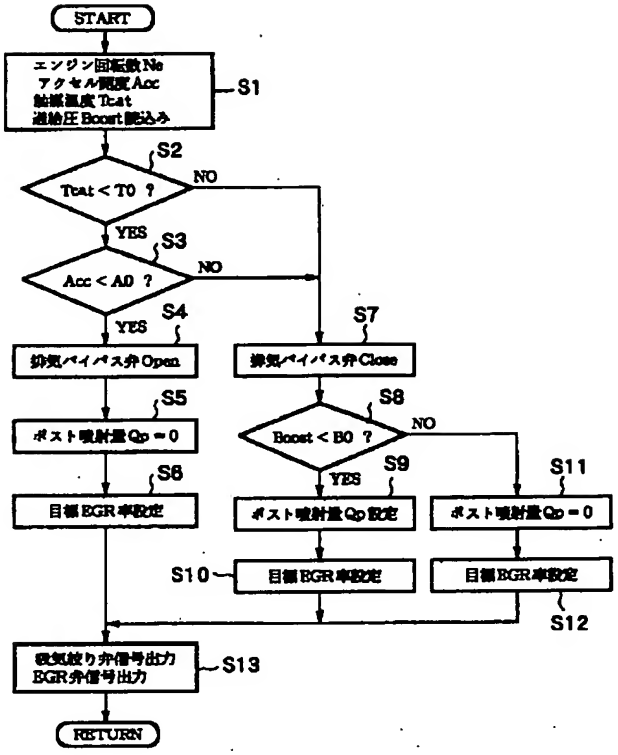


[Drawing 1]

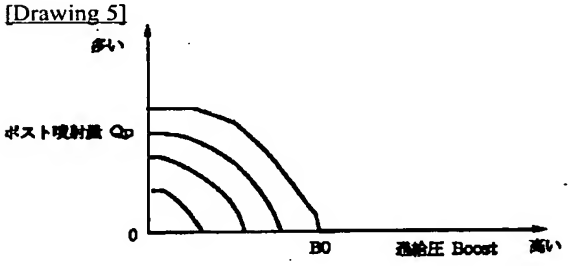




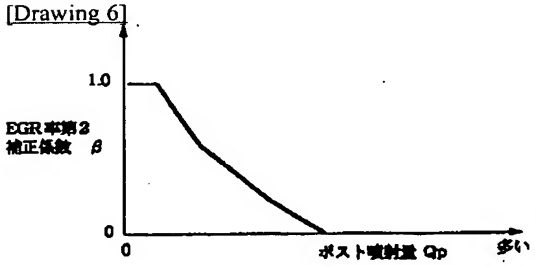
[Drawing 2]



[Drawing 5]



[Drawing 6]



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(19) JAPANESE PATENT OFFICE

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(71) Applicant: **NISSAN MOTOR CO LTD**

(72) Inventor: **KAWAMOTO KEIJI**

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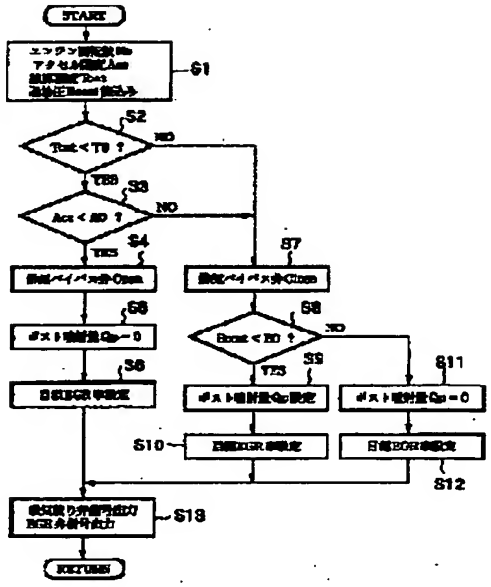
PROBLEM TO BE SOLVED: To improve the responsiveness of a supercharging pressure rise.

SOLUTION: If the temperature of an exhaust purifying catalyst is low and there is no acceleration request, exhaust bypassing a turbine of a turbosupercharger and maintaining high temperature is led to the catalyst to promote temperature raising activation (Step 1 to 4). In the process, if the catalyst is active or an acceleration request occurs, the exhaust bypassing of the turbine is prohibited, and if supercharging pressure is not higher than a given level, a postinjection is executed to elevate exhaust temperature and promote rises in turbine rotation and interlocked compressor rotation, which in turn suppresses lag in supercharging pressure rise. An excess air ratio corresponding to the postinjection quantity is controlled to suppress degradation in HC, CO and the like (Step 7 to 12).



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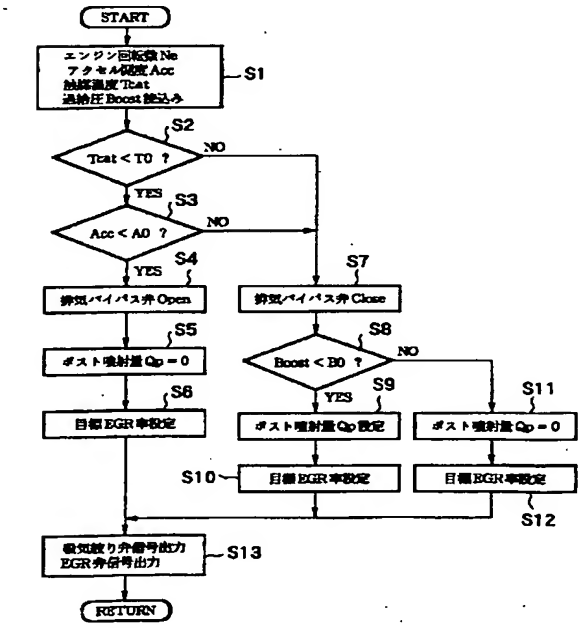
最終頁に続く

(54)【発明の名称】　内燃機関の過給圧制御装置

(57)【要約】
【課題】　過給圧上昇の応答性を高める。
【解決手段】　排気浄化触媒の温度が低く、加速要求が無いときにターボ過給機のタービンをバイパスさせて高温に維持された排気を触媒に導いて昇温活性を促進し（ステップ１～４）、この状態から触媒が活性しあるいは加速要求が発生したときに、前記タービンの排気バイパスを禁止し、かつ、過給圧が所定以下のときは、ポスト噴射を行って排気温度を高め、タービン回転及び連動するコンプレッサの回転上昇を早めて過給圧の上昇遅れを抑制する。また、ポスト噴射量に応じた空気過剰率の制御を行い、ＨＣ、ＣＯ等の悪化を抑制する（ステップ７～１２）。



1

【特許請求の範囲】

【請求項１】排気流で駆動されるタービンと共に回転するコンプレッサにより吸気過給を行うターボ過給機を搭載した内燃機関の過給圧制御装置であって、前記ターボ過給機の過給圧を上昇させるとき、燃料のメイン噴射後のポスト噴射を行うことを特徴とする内燃機関の過給圧制御装置。

【請求項２】前記メイン噴射とポスト噴射とを、電磁弁により燃料の噴射をＯＮ－ＯＦＦするインジェクタにより行うことを特徴とする内燃機関の過給圧制御装置。

【請求項３】前記ターボ過給機のタービン下流の排気通路に配置されて流入する排気成分を浄化する排気浄化手段の活性状態を判断し、該排気浄化手段が活性していないときは前記タービンをバイパスして前記排気浄化手段に導く排気のバイパス流量を大きくし、前記排気浄化手段が活性したときは前記バイパス流量を小さくするバイパス流量制御を行うと共に、前記バイパス流量を大から小に切り換えるときに前記ポスト噴射を行うことを特徴とする請求項１または請求項２に記載の内燃機関の過給圧制御装置。

【請求項４】前記タービンをバイパスするバイパス通路に介装された排気バイパス弁の開度を制御して、前記バイパス流量を制御することを特徴とする請求項３に記載の内燃機関の過給圧制御装置。

【請求項５】前記過給圧あるいは吸入空気量を検出し、該検出値が所定値を下回るとき、前記ポスト噴射を行うことを特徴とする請求項１～請求項４のいずれか１つに記載の内燃機関の過給圧制御装置。

【請求項６】前記過給圧あるいは吸入空気量が目標値に対して低いほどポスト噴射量を多く設定することを特徴とする請求項５に記載の内燃機関の過給圧制御装置。

【請求項７】排気の一部を吸気に還流させるＥＧＲ制御と、吸気通路の絞り制御との少なくとも一方を用いて空気過剰率を制御し、

前記排気浄化手段が活性していないときは、空気過剰率を低く制御し、排気浄化手段が活性後に前記ポスト噴射を実施しているときは、ポスト噴射量が多いほど空気過剰率を高く制御することを特徴とする請求項３～請求項６のいずれか１つに記載の内燃機関の過給圧制御装置。

【請求項８】運転者のアクセル操作に基づく加速要求がある場合は、前記排気浄化手段が活性していない場合であっても前記排気のバイパス流量を小さくするとともに、前記過給圧あるいは吸入空気量が所定値を下回る間は、ポスト噴射を実施することを特徴とする請求項３～請求項７のいずれか１つに記載の内燃機関の過給圧制御装置。

【請求項９】加速要求が大きいときほど前記排気のバイパス流量を小さくすることを特徴とする請求項８に記載の内燃機関の過給圧制御装置。

【請求項１０】加速要求が大きいときほど前記所定値を

2

大きく設定することを特徴とする請求項８または請求項９に記載の内燃機関の過給圧制御装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、ターボ過給機を搭載した内燃機関の過給圧制御に関する。

【０００２】

【従来の技術】車両用ディーゼルエンジンでは、一般に出力向上のため過給機を備えており、また、ＨＣ，ＣＯ，ＮＯｘを浄化する触媒やＰＭ（排気微粒子）を捕集するトラップ装置などの排気浄化手段の装着が実現されはじめている。特開平５－４４４４８号には、ターボ過給機のタービン下流に備えられた排気浄化触媒が活性していないときは、タービンをバイパスしてタービンによる冷却を抑制した排気を触媒に導き、触媒活性後は前記排気のバイパスを停止して過給を行うようにした技術が開示されている。

【０００３】

【発明が解決しようとする課題】しかしながら、排気バイパス中は過給機の回転速度が低いため、触媒が活性して排気バイパスを中止した直後に加速要求がある場合、すなわち、要求噴射量が増加する場合、過給機の応答遅れ（過給圧の上昇遅れ）が大きく、燃料噴射量の増加に吸入空気量の増加が追いつかず、空燃比が低下し、スモークの増加や運転性の悪化を招くおそれがある。

【０００４】本発明は、このような従来の課題に着目してなされたもので、過給圧の上昇遅れを抑制し、排気浄化性能も良好に維持できるようにすることを目的とする。

【０００５】

【課題を解決するための手段】このため、請求項１に係る発明は、排気流で駆動されるタービンと共に回転するコンプレッサにより吸気過給を行うターボ過給機を搭載した内燃機関の過給圧制御装置であって、前記ターボ過給機の過給圧を上昇させるとき、燃料のメイン噴射後のポスト噴射を行うことを特徴とする。

【０００６】請求項１に係る発明によると、ポスト噴射によって排気温度を応答良くかつ十分高温に高めて、タービン入口の排気のエンタルピを速やかに増大することができるので、タービン回転が急速に上昇し、該タービンと一体回転するコンプレッサによって過給圧を速やかに上昇させることができる。

【０００７】これにより、燃料を増加する加速時や過給圧が所定以下に低下したときなどに、吸入空気量が応答良く増量されるので、スモークの増加を防止でき、良好な運転性を得られる。また、請求項２に係る発明は、前記メイン噴射とポスト噴射とを、電磁弁により燃料の噴射をＯＮ－ＯＦＦするインジェクタにより行うことを特徴とする。

【０００８】請求項２に係る発明によると、電磁弁によ

る燃料噴射のＯＮ－ＯＦＦで、メイン噴射とポスト噴射とを高精度に制御することができる。また、請求項３に係る発明は、前記ターボ過給機のタービン下流の排気通路に配置されて流入する排気成分を浄化する排気浄化手段の活性状態を判断し、該排気浄化手段が活性していないときは前記タービンをバイパスして前記排気浄化手段に導く排気のバイパス流量を大きくし、前記排気浄化手段が活性したときは前記バイパス流量を小さくするバイパス流量制御を行うと共に、前記バイパス流量を大から小に切り換えるときに前記ポスト噴射を行うことを特徴とする。

【０００９】請求項３に係る発明によると、排気浄化手段［ＮＯｘトラップ触媒、酸化触媒、ＤＰＦ（ディーゼルパティキュレートフィルタ）など］が、低温で活性していないときは、排気バイパス流量を大きくすることにより、タービンへの放熱による排気の冷却を抑制して排気温度を高めることにより、排気浄化手段の活性が促進される。

【００１０】そして、排気浄化手段が活性すると、前記バイパス流量を大から小（０を含む）に切り換えて前記ターボ過給機の過給圧を上昇させる。このとき、前記ポスト噴射を行うことで、スモークの増加を防止しつつ速やかに過給圧を上昇させることができる。また、請求項４に係る発明は、前記タービンをバイパスするバイパス通路に介装された排気バイパス弁の開度を制御して、前記バイパス流量を制御することを特徴とする。

【００１１】請求項４に係る発明によると、排気バイパス弁の開度を小とすることで前記バイパス流量を小さくし、排気バイパス弁の開度を大とすることで前記バイパス流量を大きくすることができる。なお、ポスト噴射は、排気バイパス弁の開度を大から小に切り換えてバイパス流量を増大するときに行うが、排気バイパス弁の開度を小とした直後の過給圧がまだ低い状態のときも継続して行う。あるいは、ポスト噴射を排気バイパス弁の開度を大から小への切り換え前に行って、切り換え終了時に既に過給圧が高められているようにすることもできる。

【００１２】また、請求項５に係る発明は、前記過給圧あるいは吸入空気量を検出し、該検出値が所定値を下回るとき、前記ポスト噴射を行うことを特徴とする。請求項５に係る発明によると、過給圧あるいは吸入空気量が所定値に達するまでの間のみ、ポスト噴射を実施するので、燃費が悪化するポスト噴射を実施する期間を必要最小限にとどめられ、スモーク低減および運転性向上と、燃費性能とを両立することができる。

【００１３】また、請求項６に係る発明は、前記過給圧あるいは吸入空気量が目標値に対して低いほどポスト噴射量を多く設定することを特徴とする。請求項６に係る発明によると、過給圧あるいは吸入空気量が目標値に対して低いほどポスト噴射量を多く設定するので、加速初

期で過給圧の遅れが大きなときにはポスト噴射量を多く設定し、過給圧が上昇してくると徐々にポスト噴射量を減量できるので、ポスト噴射による燃費悪化を最小限に抑制しつつ、スモーク低減と運転性の向上が可能となる。

【００１４】また、請求項７に係る発明は、排気の一部を吸気に還流させるＥＧＲ制御と、吸気通路の絞り制御との少なくとも一方を用いて空気過剰率を制御し、前記排気浄化手段が活性していないときは、空気過剰率を低く制御し、排気浄化手段が活性後に前記ポスト噴射を実施しているときは、ポスト噴射量が多いほど空気過剰率を高く制御することを特徴とする。

【００１５】請求項７に係る発明によると、排気浄化手段が低温で活性していないときは、ポスト噴射を行わず空気過剰率を低く制御することで排気温度を上昇させることができ、排気のバイパスによる昇温効果と併せて排気浄化手段を速やかに昇温して活性することができる。また、ポスト噴射を実施中のときは、空気過剰率を高く制御することで、ポスト噴射時のＨＣ，ＣＯの悪化を抑制することができる。

【００１６】また、請求項８に係る発明は、運転者のアクセル操作に基づく加速要求がある場合は、前記排気浄化手段が活性していない場合であっても前記排気のバイパス流量を小さくするとともに、前記過給圧あるいは吸入空気量が所定値を下回る間は、ポスト噴射を実施することを特徴とする。

【００１７】請求項８に係る発明によると、運転者のアクセル操作に基づく加速要求があるときは、排気浄化手段が活性していない場合であっても、排気バイパス流量を小さくする（０を含む）とともに、過給圧あるいは吸入空気量が所定値に達するまでの間、ポスト噴射を実施するので、加速要求を優先して満たすことができる。

【００１８】また、請求項９に係る発明は、加速要求が大きいときほど前記排気のバイパス流量を小さくすることを特徴とする。請求項９に係る発明によると、加速要求が大きいときほど前記排気のバイパス流量を小さくすることで過給圧の上昇を早めて要求に見合った加速性を得ることができる。

【００１９】また、請求項１０に係る発明は、加速要求が大きいときほど前記所定値を大きく設定することを特徴とする。請求項１０に係る発明によると、加速要求が大きいときほど前記所定値を大きく設定することで、ポスト噴射を実施する期間を引き伸ばすことにより過給圧の上昇を維持し、要求に見合った加速性を得ることができる。

【００２０】

【発明の実施の形態】以下に、本発明の実施形態を図に基づいて説明する。図１において、エンジン（ディーゼルエンジン等の内燃機関）１の燃料噴射システムは、コモンレール２、電磁弁により燃料の噴射をＯＮ－ＯＦＦ

するインジェクタ３、及び、図示しないサプライポンプから構成されるコモンレール式燃料噴射システムを採用している。

【００２１】排気マニホールド４の下流には、ターボ過給機５のタービン５Ｔが設けられ、該タービン５Ｔと同軸上にコンプレッサ５Ｃが装着されている。吸気はコンプレッサ５Ｃで圧縮加圧された後、吸気通路６を通り、コレクタ７を介してエンジン１のシリンダ内に吸入される。吸気通路６の途中には吸気量を絞るために吸気絞り弁８が取り付けられている。また、コレクタ７には、過給圧（吸気圧）を検出する過給圧センサ９が取り付けられている。

【００２２】前記排気マニホールド４と吸気通路６とはＥＧＲ通路１０によって連通され、前記ＥＧＲ通路１０に介装されたＥＧＲ弁１１の開度によってＥＧＲガス量が制御される。タービン５Ｔ下流の排気通路１２には、触媒（排気浄化手段）１３が装着され、該触媒１３の温度を検出するため、触媒温度センサ１４が装着されている。の上流側の排気マニホールド４と下流側の排気通路１２とは、バイパス通路１５によって連通され、バイパス通路１５の開口面積は排気バイパス弁１６によって制御される。

【００２３】エンジンコントロールユニット１７には、回転速度センサ３１で検出されたエンジン回転速度信号、アクセル開度センサ３２で検出されたアクセル開度信号、触媒温度センサ１４で検出された触媒温度信号、および、過給圧センサ９で検出された過給圧信号が入力され、各信号に基づいて、インジェクタ３、吸気絞り弁８、ＥＧＲ弁１１、および、排気バイパス弁１６への作動指令信号を出力する。

【００２４】次に、図２のフローチャートにしたがって、本実施形態の制御を説明する。ステップ１では、上記各センサから、エンジン回転速度Ｎｅ、アクセル開度Ａｃｃ、触媒温度Ｔｃａｔ、過給圧Ｂｏｏｓｔを読み込む。ステップ２では、触媒温度Ｔｃａｔが所定値Ｔ０未満であるかを判定する。ここで所定値Ｔ０は、触媒の活性化温度（一般的には、排気成分を浄化する効率が５０％となる温度）に相当する値（例えば、２００°Ｃ）とする。

【００２５】触媒温度Ｔｃａｔが所定値Ｔ０未満である場合、ステップ３へ進んで、アクセル開度Ａｃｃが所定値Ａ０未満であるかを判定する。つまり、運転者の加速要求の有無を判定する。ここで、アクセル開度の変化率ΔＡｃｃが所定値ΔＡ０未満かどうかで判定してもよい。アクセル開度Ａｃｃが所定値Ａ０未満の場合、つまり加速要求が無いと判断された場合は、ステップ４以降へ進んで触媒１３の暖機を促進する制御を行う。

【００２６】ステップ４では、排気バイパス弁１６の開度を全開とし、タービン５Ｔのバイパス量を増加させる。これにより、タービン５Ｔへの排気の放熱を抑制で

き、触媒に導かれる排気の温度低下が抑制される。ステップ５では、ポスト噴射量Ｑｐ＝０とする。触媒暖機時には長時間のポスト噴射を禁止して燃費悪化、排気性能の低下を抑制する。

【００２７】ステップ６では、以下の手順で目標ＥＧＲ率を設定する。まず、図４のテーブルからエンジン回転速度Ｎｅとアクセル開度Ａｃｃに基づき、基本目標ＥＧＲ率ＭＥＧＲ０を設定する。次に、図４のテーブルから触媒温度Ｔｃａｔに基づき、ＥＧＲ率第１補正係数αを求める。ＥＧＲ率第１補正係数αは、図示のように触媒温度Ｔｃａｔが低いほど大きい値に設定されている。最後に、基本目標ＥＧＲ率ＭＥＧＲ０とＥＧＲ率第１補正係数αの積を目標ＥＧＲ率ＭＥＧＲとする。

【００２８】同一過給圧の条件で、ＥＧＲ率を増加させると、シリンダへ吸入する空気量が減少し、燃料噴射量との割合、すなわち、空気過剰率が低下する。上記の動作によると、触媒温度Ｔｃａｔが低いほど目標ＥＧＲ率が高く補正されるため、空気過剰率は低下する。このように、空気過剰率を低下させることにより、吸気中の低温な空気（新気）の量が少なくなり、高温なＥＧＲガスの増量による吸気温度上昇とも相まって排気温度を高めることができ、触媒の昇温効果を高めることができる。

【００２９】ステップ２で、触媒温度Ｔｃａｔが所定値Ｔ０以上で触媒が活性していると判断された場合、あるいは、ステップ３でアクセル開度Ａｃｃが所定値Ａ０以上の加速要求があると判断された場合は、過給を優先して加速性能を確保するようにステップ７へ進み、排気バイパス弁１６の開度を全閉とし、タービン５Ｔへのバイパスを禁止する。なお、ステップ３からステップ７に進んだ場合は、加速要求に応じて排気バイパス弁１６の開度を設定するようにしてもよい。すなわち、全閉とするのではなく、Ａｃｃ－Ａ０（あるいは△Ａｃｃ－△Ａ０）が大きいときほど全閉に近づけるようにして、バイパスする割合を減少させるようにしてもよい。

【００３０】ステップ８では、検出した過給圧Ｂｏｏｓｔが所定値Ｂ０未満であるかを判定し、所定値Ｂ０未満の場合は、ステップ９で、図５のマップに基づきポスト噴射量Ｑｐを設定する。ここで、ポスト噴射量Ｑｐは、過給圧Ｂｏｏｓｔが低いほど大きい値に設定されている。すなわち、過給圧Ｂｏｏｓｔが低いほどポスト噴射量Ｑｐを多くして排気温度を十分に高めることにより、タービン入口のエンタルピを大きくし、タービンによる排気エネルギ回収効率を高め、コンプレッサによる吸気圧縮仕事を増加させて、過給圧を速やかに上昇させることができる。ここで、ステップ３から進んできた場合は、所定値Ｂ０は運転条件（加速要求）に応じて設定してもよい。すなわち、Ａｃｃ－Ａ０（あるいは△Ａｃｃ－△Ａ０）が大きいときは所定値Ｂ０を大きく設定するようにしてもよい。また、過給圧の代わりに、吸入空気量に基づいて判定してもよい。すなわち、吸入空気量Ｑ

ａｃ＜目標値Ｑａｃ０のとき、ステップ９へ進む。

【００３１】次のステップ１０では、以下の手順により目標ＥＧＲ率を設定する。まず、ステップ６と同様に図３のマップからエンジン回転速度Ｎｅとアクセル開度Ａｃｃとに基づいて、基本目標ＥＧＲ率ＭＥＧＲ０を設定する。次に、図６のテーブルからポスト噴射量Ｑｐに基づいてＥＧＲ率第２補正係数βを求める。ＥＧＲ率第２補正係数βは、図示のようにポスト噴射量Ｑｐが多いほど小さい値に設定されている。最後に、基本目標ＥＧＲ率ＭＥＧＲ０とＥＧＲ率第２補正係数βの積を目標ＥＧＲ率ＭＥＧＲとする。これにより、ポスト噴射量Ｑｐが多いほど、目標ＥＧＲ率ＭＥＧＲを低くするため、空気過剰率を高く設定することになる。すなわち、過剰ＥＧＲによってポスト噴射された燃料が失火することを防止しつつＥＧＲによる昇温効果を得られるように、目標ＥＧＲ率を設定する。

【００３２】ステップ８で過給圧Ｂｏｏｓｔが所定値Ｂ０以上と判定された場合は、ステップ１１へ進み、ポスト噴射量Ｑｐ＝０とする。また、次のステップ１２で、図３のマップからエンジン回転速度Ｎｅとアクセル開度Ａｃｃに基づいて、基本目標ＥＧＲ率ＭＥＧＲ０を読み取り、これを目標ＥＧＲ率ＭＥＧＲとする。つまりポスト噴射量Ｑｐによる目標ＥＧＲ率の減少補正を行わない。すなわち、ポスト噴射は排気温度を応答良くかつ十分に高められるが、燃費やＨＣ，ＣＯの悪化につながるため、過給圧が小さいときだけ短時間行い、ある程度上昇した後はＥＧＲによる昇温に移行させて過給圧が目標値まで速やかに達するように十分高い昇温効果を維持できるようにする。

【００３３】最後に、ステップ１３で上記ステップ６，１０，１２で設定された目標ＥＧＲ率に基づいて吸気絞り弁１０およびＥＧＲ弁１４の開度信号を演算し、出力する。なお、上記実施形態では、空気過剰率を制御する際にＥＧＲ制御のみ行う場合について説明したが、吸気＊絞り弁１０を併用して制御してもよい。すなわち、吸気絞り弁１０を絞り制御して直接空気量を減少させることで、ＥＧＲ制御単独の場合より応答良く、かつ、十分に空気過剰率を小さくすることができる。

【００３４】また、本実施形態では、排気バイパス弁１６を閉じてからポスト噴射を行っているが、ポスト噴射の開始時期を排気バイパス弁１６の閉弁時期より前、もしくは同時に設定してもよい。

【図面の簡単な説明】

【図１】本発明の実施形態のシステム構成を示す図。

【図２】上記実施形態の制御ルーチンを示すフローチャート。

【図３】上記実施形態で用いる基本目標ＥＧＲ率を求めるマップ。

【図４】同じくＥＧＲ率第１補正係数αを設定するマップ。

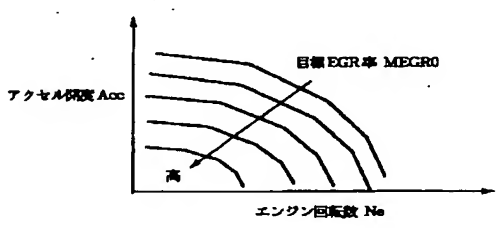
【図５】同じくポスト噴射量Ｑｐを設定するテーブル。

【図６】同じくＥＧＲ率第２補正係数βを設定するマップ。

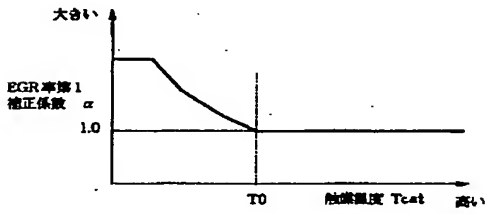
【符号の説明】

１	エンジン
３	インジェクタ
５	ターボ過給機
５Ｔ	タービン
５Ｃ	コンプレッサ
８	吸気絞り弁
９	過給圧センサ
１０	ＥＧＲ通路
１１	ＥＧＲ弁
１３	触媒
１４	触媒温度センサ
１５	バイパス通路
１６	排気バイパス弁

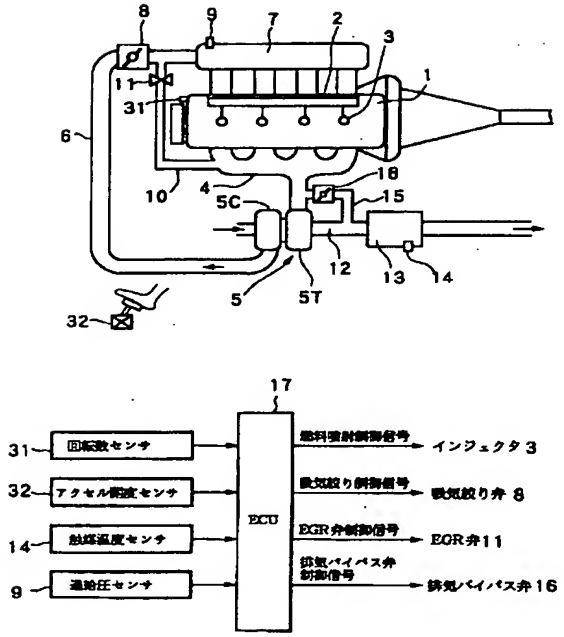
【図３】



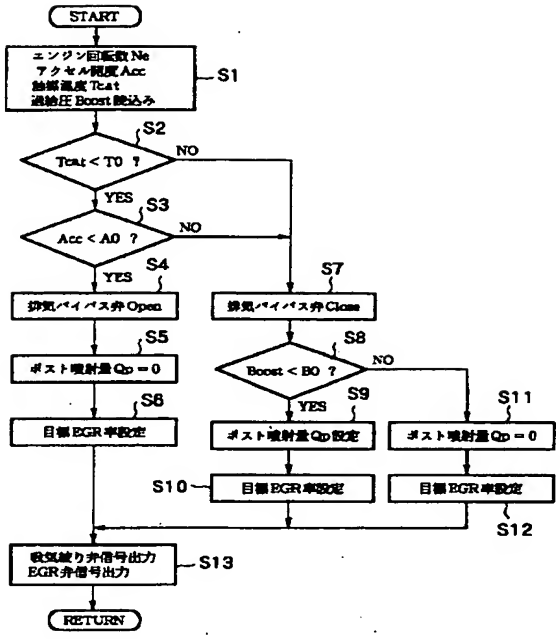
【図４】



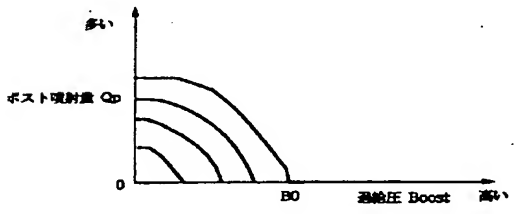
【図１】



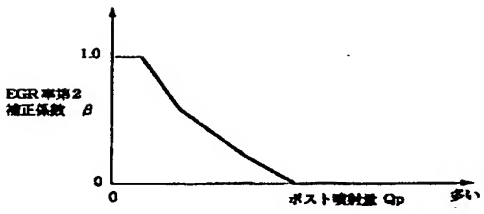
【図２】



【図５】



【図６】



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